PCT/NO00/00076
01-06-2001

09/936390

A METHOD AND AN APPARATUS FOR STEREOPROJECTION OF PICTURES

The invention relates to a method and a device for stereoprojection of pictures.

Our depth sight is connected with the fact that right and left eye sees the surroundings from a different place and under a somewhat different angel. One eye sees a picture differing from the picture that the other eye sees, and the brain co-ordinates the two such that we experience three dimensions.

It is known to create pictures with a three-dimensional effect by letting right and left eye see a picture of its own, e.g. two photos taken from two points spaced correspondingly to a normal mutual distance between the eyes of a human being. There exist special cameras for such purposes, so-called stereo cameras, having two objectives.

In recent years, techniques used in order to achieve three-dimensional effect in photos, developed to comprise pictures that can be transferred electronically, such as video and

digitized images, and it has been developed technique that makes it possible to show both still pictures and moving pictures on screen.

To let a viewer experience three-dimensional effect, the picture photographed or made in some other way for the right eye must be shown for the right eye, and the picture photographed or made in some other way for the left eye, must be shown for the left eye. If both pictures are shown for both eyes, a blurred (unsharp) picture is experienced, and the three-dimensional effect fails.

In order to avoid that right eye sees the picture belonging to left eye, and vice versa, the pictures may be viewed through an ocular for each eye, in a so-called stereoscope. This gives a good three-dimensional effect, but it is not very suited for pictures to be viewed by several persons simultaneously, e.g. in a cinema hall.

It is known to divide right and left picture in narrow stripes which are assembled alternately to form one picture. When viewing the picture stripes through glass or plastic, where prisms are formed parallel to the pictures stripes, it is achieved that right eye sees picture stripes belonging to right picture, and that left eye sees picture stripes belonging to left picture.

Further, it is known to print two pictures, one for right eye and one for left eye in registry on paper. Such pictures are viewed through special spectacles separating the pictures from each other, so that right eye sees one picture and left eye sees the other picture.

In one type of spectacles, spectacle glasses having different colour for each eye is used, as an example a red and a bluish green. Each picture is prefiltered before printing. Right picture is printed in complementary colour to left picture and left spectacle glass, and vice versa. Then, each eye sees a different picture. The technique is also used when projecting two pictures in registry on a screen (canvas), and it is possible to show moving pictures, film and animations in this way.

The technique which also may be used for television, has several disadvantages. The filtration and the spectacle glasses influence the colour balance, and it is not achieved an adequate separation of the pictures for right and left eye. Each eye experiences a portion of the picture meant for the opposite eye and the picture is, thus, experienced as unsharp.

Another known way of separating pictures for right and left eye consists in that a picture for each eye is projected in registry on a screen by means of polarized light. The polarization for the one picture is at right angles on the polarization for the other, and the viewer uses spectacles having glasses each correspondingly being polarized for letting through light for one of the pictures only. By means of this, less colour error is achieved than by using colour filter, and a better picture separation is obtained.

Upon transfer of electronic pictures, such as video pictures, it has been found to be difficult to synchronize two parallel picture signals in a flickerfree way. In connection with projecting video pictures or pictures from computers, it has proved advantageous to transfer picture for alternate right

and left eye in a common channel in lieu of in two parallel channels. This means that every second picture transferred, belongs to right eye, while the rest belongs to left eye. The pictures are projected on a screen and are viewed through spectacles having glasses which can shut and open in step with an electric signal alternating synchronously with the pictures. Such spectacle glasses utilize liquid crystals. Left spectacle glass is shut while right picture is projected, and right spectacle glass is shut while left picture is projected.

This known technique gives a good effect, but it has several disadvantages. The spectacles are expensive, and they have to be provided with an electric signal for synchronization with the stream of pictures, which can be difficult in a cinema hall. In practice, the technique is usable only for stationary plants. Also, great demands are made upon the projector which has to operate with double picture frequency. The high picture rate involves that reasonable projectors in which the picture is formed by mans of liquid crystals, can not be used.

The object of the invention is to provide a method and a simplified device in order to achieve stereo projection of pictures represented by a picture signal which cyclically alternates between picture for right and left eye.

The object is obtained by means of features as defined in the following description and the following claims.

According to the invention, a picture signal is received which in known manner alternate between picture for right and left eye.

First picture received in incoming picture signal, is decoded and, possibly, digitized into a first digital picture which is stored in a first digital storage device, typically a cache memory in a computer. First digital storage device is searched as known, and from the content is formed an outgoing first picture signal. Second picture received in incoming picture signal, is decoded and digitized correspondingly to first picture, and is stored in a second digital storage device. Second digital storage device is searched, and from the content is formed a second outgoing picture signal. Following pictures received in incoming picture signal are, thereupon, stored alternately in first and second digital storage device.

First outgoing picture signal is passed to a first projector, and second outgoing picture signal is passed to a second projector. Even if incoming picture signal has double picture rate, each projector operates with normal picture rate, so that ordinary projectors can b used.

Each of said first and second digital storage device may advantageously be divided into two or more areas used cyclically. Thus, third picture can be received, decoded, digitized and stored separately from first picture and without overwriting the same. Fifth picture may be stored at the same place as first picture and overwrite the same, while third picture is intact and may be projected during receipt and storing of fifth picture.

Correspondingly, fourth picture can be received, decoded, digitized and stored separately from second picture, without overwriting the same. Sixth picture can be stored at the

same place as second picture and overwrite the same while fourth picture is projected.

With such a division and cyclic use of first and second digital storage device, great tolerance in respect of the picture rate in incoming picture signal is achieved. This is a great advantage when picture signals are transferred through data network where the transfer speed may vary greatly, and where picture data may get lost.

The picture from one projector is projected such that it can be viewed by one eye, and the picture from the other projector is projected such that it can be viewed by the other eye. In a preferred arrangement, picture from first and second projector is projected in registry on a screen by means of polarized light, and the pictures are viewed through spectacles having polarized glass, such as explained.

By means of the invention is achieved that each and every projected picture can be renewed in a cycle that only depends on the frequency with which the digital storage devices are scanned. Even if this may involve that the same picture is shown several times if incoming picture rate descends, a substantial reduction of flicker is obtained as compared with known technique where picture projection follows incoming picture rate.

A device for carrying out the described method is described in the following by means of two exemplary embodiments, and reference is made to attached drawings, wherein:

Figure 1 shows a simplified block scheme for a first embodiment of the invention;

Figure 2 shows a simplified block scheme for a second embodiment of the invention.

In figure 1, the reference numeral 1 denotes a right projector adapted to project a picture to be seen by right eye, in registry with a projected picture from a corresponding, left projector 2 projecting a picture to be seen by left eye.

Right projector 1 is coupled to and receives its picture signal from a right picture generator 3. Left projector 2 is coupled correspondingly to a left picture generator 4. Each picture generator 3, 4 is adapted to scan a picture storage and generate a picture signal causing the projector 1, 2 belonging thereto, to project a visible picture belonging thereto, on a screen.

Right picture generator 3 is adapted to scan periodically an area within a right picture storage 5, and left picture generator 4 is correspondingly adapted to scan periodically an area within a left picture storage 6. Right picture storage 5 is divided into a first right picture area 7 and a second right picture area 8. Left picture storage 6 is correspondingly divided into a first left picture area 9 and a second left picture area 10.

A right picture selector 11 is adapted to react on a control signal and connects, alternately, right picture generator 3 to first or second picture area 7, 8 in right picture storage 5 and, thus, determines if right projector 1 projects a picture based on first or second picture area 7, 8. A left picture selector 12 is, correspondingly, adapted to react on a control signal, alternately connecting left picture

generator 4 to first or second picture area 9, 10 in left picture storage 6, thus determining if left projector 2 projects a picture based on first or second picture area 9, 10.

A right decoder 13 is adapted to receive a picture signal and store values representing the picture signal, in right picture storage 5 on a format which right picture generator 3 is adapted to convert to picture signals for right projector 1. A left decoder 14 is, correspondingly, adapted to receive a picture signal and store values representing the picture signal, in left picture storage 6 on a format which left picture generator 4 is adapted to convert into picture signals for left projector 2.

Between right decoder 13 and right picture storage 5, is disposed a right area selector 15 adapted to respond to a control signal, alternately connecting the decoder 13 to second or first picture area 8, 7 in right picture storage 5 and, thus, determine whether the decoder 13 stores values in second or first picture area 8, 7. Right picture selector 11 and right area selector 15 alternate such that right picture generator 3 and right decoder 13 are coupled to opposite picture area 7, 8 in right picture storage 5. Intermediate left decoder 14 and left picture storage 6 is, correspondingly, disposed a left area selector 16 adapted to respond to a control signal, alternately connecting the decoder 14 to second or first picture area 10, 9 in left picture storage 6 and, thus, determine whether the decoder 14 is storing values in second or first picture area 10, 9. Left picture selector 12 and left area selector 16 alternate such that left picture generator 4 and left decoder 14 are coupled to opposite picture area 9, 10 in left picture storage 6.

A page selector 17 is adapted to respond to control signals and alternately connect a conductor 18 for an incoming picture signal to right decoder 13 or left decoder 14.

A controller 19 is adapted to sense the incoming picture signal and recognize signal values or signal codes defining a new picture and giving switching signals to the page selector 17 for each picture. Right decoder 13 is adapted to give switching signal to right area selector 15 and right picture selector 11 each and every time the decoder has stored a new picture in right picture storage 5. Left decoder 14 is adapted to give switching signal to left area selector 16 and left picture selector 12 each and every time the decoder has stored a new picture in right picture storage 6.

Each picture generator 3, 4 feeds new picture to right or left, respectively, projector 1, 2, following a fixed picture rate, e.g. sixty times per second, even if incoming picture rate varies. In lack of new picture information, the picture generators 3, 4 will repeat last picture.

The right picture selector may alternate while the right picture generator 3 is about transferring picture signals to the projector 1. Advantageously, the picture generator 3 may be formed with internal storage, not shown, having a capacity for one picture, only scanning right picture storage 5 each time it has completed the transfer of one picture to right projector 1. Thus, a projected picture consisting of parts from two pictures is avoided. Correspondingly, left picture selector 12 may come to alternate while left picture generator 4 is in the course of transferring picture signals to the projector 2. Advantageously, the picture generator 4 may also be formed with internal storage, not shown, having a

capacity for one picture, only scanning left picture storage 6 each and every time it has completed to transfer a picture to left projector 2. Thus, a projected picture consisting of parts from two pictures is avoided.

A second and preferred embodiment of the invention is shown in figure 2, where the projectors 1, 2 are connected to a common picture storage 20 through a picture 11 selector and 12 of their own, respectively. Possible picture generator for each of the projectors 1, 2 is not shown, but it may be disposed correspondingly to the described one. The picture storage 20 is divided into four picture areas 21, 22, 23, 24. A controller 25 is adapted to read and store picture signal in the conductor 18 in the picture storage 20 one of the picture areas 21, 22, 23, 24 through an area selector 26. Pictures are stored in consecutive succession, so that first picture is stored in picture area 21, the next in 22 and so forth until all picture areas have been used. Next picture is stored in 21, and the process repeats itself, the picture storage 20 being organized as a ring buffer.

Through its picture selector 11, projector 1 reads a picture stored in picture area 21 or 23. Through its picture selector 12, projector 2 reads a picture stored in picture area 22 or 24. Thus, each projector 1, 2 reads every second picture from the picture storage 20.

The alternating cycle for the picture selectors 11 and 12 is adjusted such that the gathered projected picture becomes as free of flicker as possible. The picture cycle at each projector 1, 2 may e.g. be equal to half of the cycle in incoming pictures when it is lower then one predetermined value and, thereupon, restricted to an upper picture cycle if

incoming picture cycle increases beyond the same. Typically, incoming picture cycle should be lower than 85 pictures per second cause a corresponding outgoing picture cycle. Above this limit, e.g. outgoing picture cycle may be halved.

Likewise, the picture cycle to each projector 1, 2 can be restricted to a minimum value, so that a stable picture is maintained at incoming picture signal which has an extremely low cycle.